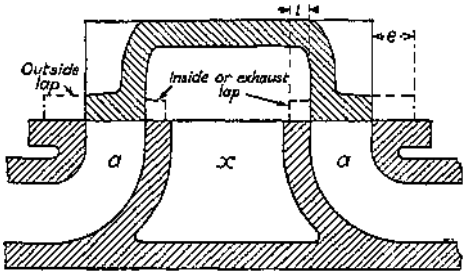
where M and T are the bending and twisting moments as before. The stress / = MJo-ogSad^3, but in this case the stress figured is a tensile stress.

In the case of overhung cranks the crank-pin is fixed in the crank cheek. The crank-pin is designed for bearing pressure which should not exceed 600 Ib. per square inch. The length may be ij times the diameter. The part fixed in the crank is a little larger in diameter than the p;n and is parallel, a fillet being left at the change of sections. The pin is fixed in by shrinkage.

The crank is usually a plain mild-steel slab, having a thickness equal to diameter of shaft X 0-6. The thickness of metal round the hole for the pin may be equal to the radius of the latter, and the metal round the hole for the shaft may be equal to the radius of the hole X 0-85 to 0-9.



The crank seat on the shaft is slightly greater in diameter than the journal, to which it is joined by a fillet. The crank is fixed on by shrinkage, a round key, half in each part, being afterwards driven in. The key may have a diameter of about one-eighth of the diameter of the crank-shaft.

Fig, 14.—Slide Valve

The above are usual proportions for mill engines, running under ordinary conditions, but

it would be well to check the bending stresses on the pin, also in the crank in both planes, for any unusual conditions of steam pressure, allowing a stress of 8000 lb. per square inch.

Valves **and** Valve Gear.—The slide valve shown in fig. 14 is the most common type, and when used with low or moderate pressures, is quite satisfactory. With high pressures, or with superheat, the faces of the valve and cylinder are likely to be cut. When large, this type of valve requires considerable power to drive it. The valve, as shaded, exactly covers the three ports. If it projects outside, it has *outside* or *steam lap,* the amount of which is measured by *e* in the figure; if it projects inside as well, it has *inside* or *exhaust lap,* marked *i.*

In the first place, a valve with no lap will be considered. In the arrangement shown in fig. 14, there are two steam ports *a* with the exhaust port *sc* in the centre. The flat face of the valve is equal in length to the total width of the three ports, in addition to the width of the bars of metal between the exhaust port and the steam ports. The valve is shown in its central position. Assuming the valve to be moved to the right, the left-hand end of the cylinder would be put into communication with the steam chest, in

which the valve works, and the right-hand end with the exhaust passage, and the piston would be forced from left to right. While the piston was moving throughout its stroke, the valve would have completely opened the port, and then moved back to close it, being in the full open position